Attentional Development in Japanese Culture

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Human infants depend upon caregivers for the longest period of any animal. During the first year of life, maturation of brain structures makes it possible to orient to sensory events. Soon afterwards, maturation of more frontal brain areas allows for the regulation of behavior and mental states. These functions grow within the dyad involving the child and the caregiver as a carrier of the culture and socialization (Posner & Rothbart, 1998).

As children reach the early school age, they begin to acquire new cognitive skills, such as reading, through learning experiences. Changes in brain processes might take place over the time course of learning, but how reading skill develops during the acquisition of literacy in the first language is relatively poorly understood (McCandliss, Posner & Givon, 1997). In a review of reading, Posner & Carr (1992) suggested the ecological significance of how culturally specified forms of learning are integrated with biologically prepared forms.

In this paper, child development in Japanese culture is discussed in three stages; first, infant and maternal responsiveness, second, preschool children and group nurture, and third, school children and learning the Kanji writing system. Concerning each period of time, stimuli that may be culturally specific are discussed in order to clarify their effects in Japanese child behavior.

Infants

In a study comparing varieties of maternal responsiveness to young infants (5-month-old) in different cultures, Bornstein et al (1992) noted that Japanese mothers would tend to emphasize responsiveness oriented within the dyad and American mothers to emphasize environment-oriented responsiveness by incorporating the world outside the dyad into their interaction. That is, when infants look at their mothers, Japanese mothers use eye-to-eye contact for keeping the dyadic interaction, and American mothers more often direct their infants' attention to properties, objects, or events in the environment.

This result is consistent with the difference between American and Japanese best sellers on

childcare, namely, Dr. Spock's and Dr. Matsuda's Books of Childcare. Although both doctors are pediatricians, for childcare Dr. Spock emphasizes "Control of Nature" and "Tendency for Individualism", while Dr. Matsuda emphasizes "Adoption of Nature" and "Tendency for Collectivism" (Hosotsuji, 1983).

Concerning the foregoing cultural differences, the frequency of maternal encouragement of attention to properties, objects and events in the environment is reported to relate to habituation in 4-month-olds. Behaviorally, habituation refers to the decrease in responsiveness that occurs when an object becomes familiar or a signal is repeated. That is, mothers of fast habituation tend to encourage more attention to properties of objects and the surrounding environment (Bornstein, 1985). Still more, some studies (Bornstein and Sigman, 1986; Fagan, 1984) suggest that infants who show more rapid habituation and stronger preferences for novelty are likely to perform better in childhood tests of intelligence and language.

One possibility based on the difference of maternal responsiveness could be that Japanese infants show slower habituation than American infants do. Although Bornstein & Ludemann (1989) did not find any significant difference of habituation between American and Japanese infants, their observations were conducted by different experimenters in different settings. Presumed slower habituation could be related to the greater duration of orienting, i.e., the baby's attention to and/or interaction with a single object for extended periods of time, in the Infant Behavior Questionnaire (Gartstein & Rothbart, submitted). This measure, Duration of Orienting, is reported to predict later fear, sadness and shyness, because more fearful children were not looking around for social stimulation (Rothbart, Ahadi & Evans, 2000). These speculations appear to be consistent with Vogel's observation (1967) that Japanese children could have more fear or anxiety with regard to the strangers.

Preschool children

Azuma, Kashiwagi & Hess (1981) compared the cognitive style, reflection-impulsivity, between Japanese and American children. According to Messer (1976), the literature suggests that the search for reflectives involves greater concentration on homologous parts of the variants. By contrast, the viewing behavior of impulsives is less systematic and more global. Reflection-impulsivity takes as its critical measure perceptual tasks, Matching Familiar Figures (MFF) and Tactual Visual Matching (TVM). In MFF, children are to select from an

array of choices the one that exactly matches the standard, and speed and errors are used as combined criteria. In TVM, children are to select the one that exactly matches the one they touch in the box. Azuma et al. (1981) applied these tasks to children of age 5 in both the U.S. and Japan.

In results of both tasks (Tables 1 & 2), latencies of Japanese children were longer than of American and error rates of Japanese were lower than of American. It seems that Japanese children take a more prudent approach. Azuma (1994) interpreted these results from the view of the Japanese ways of child rearing. In Japan, children are trained to behave differently depending on the social situation, or on the social relationship. Peak (1991) points out that this kind of training might be given especially through Japanese group nurture. That is, the trained attitude of Japanese children to perceive extrinsic social needs and take their own social role seriously could result in the behavior in these tasks.

Table 1 Reaction time (sec) and Number of errors on MFF (Azuma et al., 1981)

	RT (SD)	Number of Error (SD)
Japan (n=58)	92.43(58.28)	9.95(3.69)
U.S.A.(n=67)	72.93(116.38)	12.67(11.21)

Table 2 Reaction time (sec) and Number of errors on TVM (Azuma et al., 1981)

	RT (SD)	Number of Error (SD)
Japan (n=58)	105.86(86.48)	4.36(1.70)
U.S.A.(n=67)	92.42(165.64)	4.96(1.63)

Moreover, Azuma (1994) reported the relationship of cognitive functions between children of preschool and of school ages. MFF scores were closely related to the school records in Japanese children, but they did not show any relation with school records in the U.S. children. Instead, a positive correlation between TVM scores and school records was predominantly found in the U.S. children. Azuma (1994) mentioned that TVM could be an intrinsic-motivated fun task and U.S. children might proceed on their own device. On the other hand, MFF needs reflection but it is not a fun task and Japanese children might be socially driven to fulfill dependency needs.

At present, the enrollment rate of 4 to 6-year-old children in kindergartens is 48.0% and in

day nurseries 26.7%, that is to say 75% of children experience two years of preschool group care and education (Ministry of Health and Welfare, 1999). Regarding the care and education in day nurseries, two aspects might be pointed out as Japanese specific, first, an explosive aspect of energetic outside play and second, a restrictive aspect, such as a nap all at once and cooperation on Sports Day (Akino, personal communication).

Ruff & Rothbart (1996) noted that in the preschool years, attention and behavioral control could be related mutually in important ways. The tendency to be reactive and impulsive and the level of control to resist distractions and temptations will interact with children's socialization to help determine the development of attention.

School children

In written Japanese, Kana characters are phonetic symbols for syllables and Kanji characters are non-phonetic graphic symbols for lexical morphemes. Kana syllabic script is generally taught in school when the child first learns to write. Kanji are slowly introduced one at a time after the first year of school. Because most of the Kanji have more complex structures than Kana, different respective neural mechanisms for Kanji and Kana writing have been assumed (Imura, 1943). Thus, the Kanji learning experience might relate to some specific behaviors. Here, I first discuss "Kusho" and, second, "lateral bias of spatial attention for perceiving Kanji characters".

According to Sasaki (1984), "Kusho" is defined as writing-like finger movement without any physical and visible trace. Figure 1 shows developmental changes in appearance of "Kusho" behavior. Kusho could be obtained through the Kanji learning process in which Japanese children are forced to write a huge number of Kanji over and over. Thus, Kusho behavior is observed in children who have learned a certain amount of Kanji. Figure 2 presents the accumulated curve of 881 characters called educational Kanji. Kusho behavior was also observed among Chinese subjects who use Chinese characters and both Japanese and Chinese subjects show Kusho behavior even in remembering English spellings (Sasaki & W-atanabe, 1984).

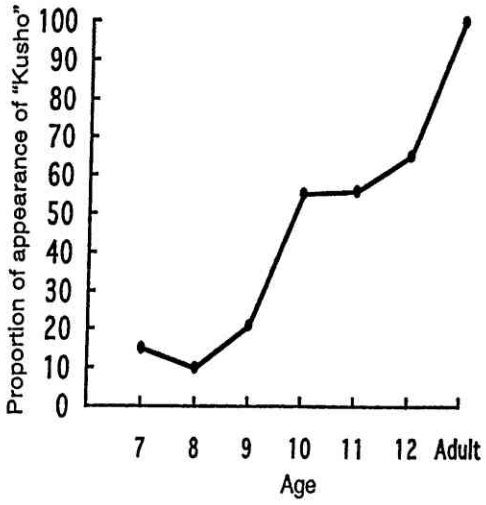

Figure 1: Developmental changes of proportion of "Kusho" (Sasaki, 1984)

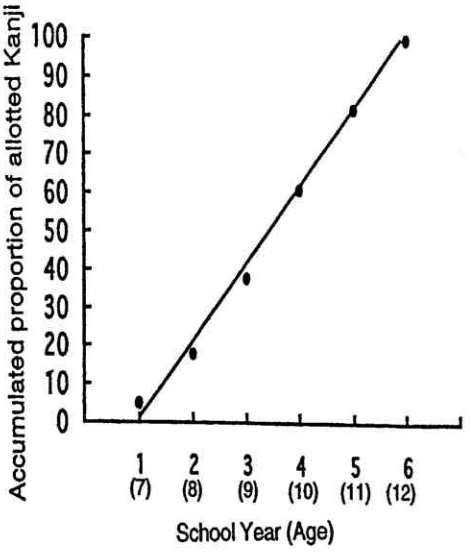

Figure 2: The accumulated curve of 881 Kanji characters for education (Sasaki, 1984)

Regarding a second aspect specific to the Kanji learning experience, my previous lexical decision experiments (Nakagawa, 1991, 1994) are introduced. In these studies, to think about the underlying neural areas during lexical decisions, the role of the left and right cerebral hemisphere was examined using divided-visual field presentation. Because of the anatomy of the human visual system, when the two eyes are fixated, visual information from each side of the fixation point projects directly to the contra-lateral visual cortex. Performance to a given stimulus in one visual field might reflect the processing way or competence of the right or left hemisphere, although information can cross over fiber bundles and reach both hemispheres.

In figure 3, the procedure is presented vertically and there are non-cued and cued conditions (Nakagawa, 1994). Each trial began with a fixation cross. The prime was presented in the center location for 60 milliseconds (msec). This was followed by the fixation point for 690 msec. The target was presented at the end of 750-msec SOA for 150msec randomly to the left or right visual field. On the cued trials, 590 msec after the prime presentation four LEDs making a square in which a target would appear were brightened for 70 msec. After a 30-msec delay, the target was presented for 150 msec. All spatial cues were valid. Subjects were instructed to fixate on the central cross and to attend to the first

stimulus Kanji in the center. Their task was to determine whether the second stimulus was or was not a real Kanji. Responses were made by pressing one of two keys with the index and middle fingers of the right hand. Similar experiments were conducted, using English stimuli (Nakagawa, 1991).

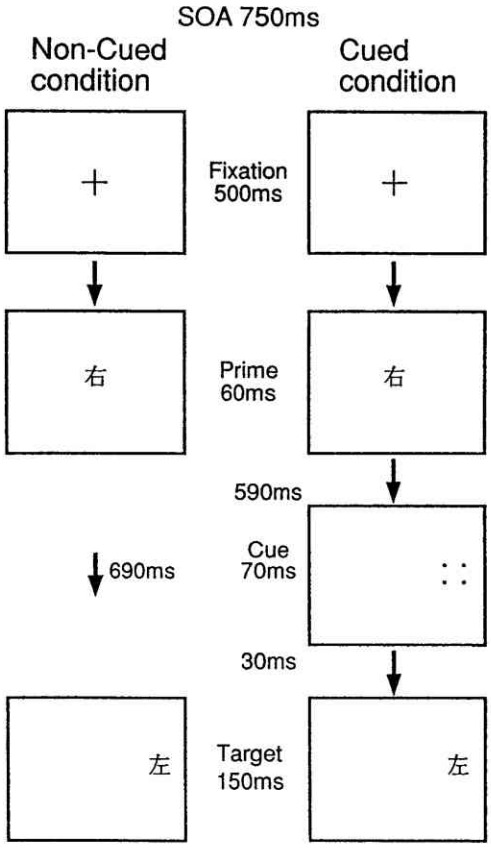

Figure 3: The procedure of Experiment 4
(Nakagawa, 1994)

In the original experiments with 4 kinds of prime-target relationships, "×" was given as a neutral prime in the Kanji study and "blank" was given in the English study. Only the results under the neutral condition are shown here to simplify the story. Figure 4 shows mean reaction time for the left and right visual fields under the neutral condition with or without the spatial cue. As can be seen, in Kanji, the spatial cue decreased reaction times only to targets in the left visual field. In the English study, reaction times were facilitated by the cue equally in both visual fields. These results support the interpretation that the orienting attention system creates a right hemisphere bias toward processing Kanji.

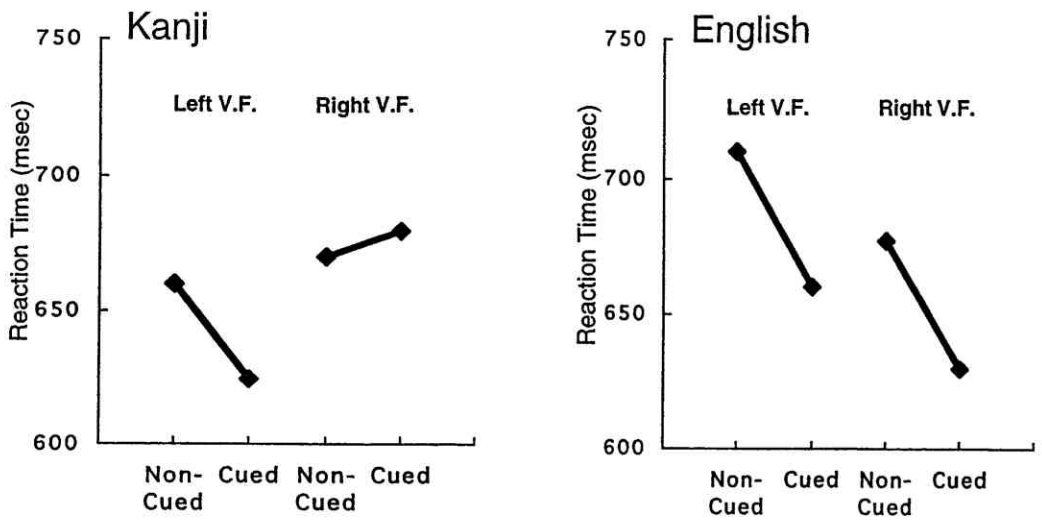

Figure 4: Mean lexical decision latencies (in msec) for each target condition

Final Remarks

In this paper, I introduce some experimental results and speculations regarding child development in Japanese culture. Recent studies indicate that the cerebral cortex is extremely sensitive to experiential factors early in life (Johnson, 1993). The maturation of the cortex could be influenced by the way of "soothing", the interaction with the more experienced members of their communities and the culturally engineered forms of learning. Much more work is needed both to clarify the cultural difference of child experience and to explore its relationship to the underlying neural circuitry.

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